

World's Fair Edition.

IRRIGATION SOUTHERN CALIFORNIA





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IRRIGATION IN SOUTHERN CALIFORNIA

ISSUED FOR THE USE OF THE DELEGATES
TO THE

INTERNATIONAL IRRIGATION CONGRESS,

LOS ANGELES, CALIFORNIA,

October 10-15, 1893,

BY THE

PUBLICATION COMMITTEE OF THE CONGRESS.

FRED L. ALLES, Chairman.

C. D. WILLARD, Secretary.

GEO. RICE, HARRY BROOK,

I. H. LA VEEN, A. PHILLIPS,

R. E. ARCHER, T. B. MERRY.

WRITTEN BY

HARRY ELLINGTON BROOK,

Author of "Southern California," "The Land of Sunshine," etc.

LOS ANGELES PRINTING COMPANY,
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FOR
INFORMATION
ABOUT
CALIFORNIA
WRITE TO
Chamber of Commerce
LOS ANGELES

INTERNATIONAL IRRIGATION CONGRESS.

On the 10th of October, 1893, there will convene in the city of Los Angeles one of the most notable gatherings ever held in the West. It is the International Irrigation Congress, to which all are invited who are interested, either theoretically or practically, in the subject of irrigation.

The Congress will remain in session five days during which time papers will be read and discussions carried on upon the following subjects: Irrigation Engineering, State laws on Irrigation, National Legislation on Irrigation, Irrigation Securities and Finance, the Relation of Irrigation to Agriculture and Horticulture, Irrigation Machinery and Appliances, etc.

The Congress has been called to meet in Los Angeles by the National Committee of the Association, whose headquarters are at Salt Lake City, A. L. Thomas, Chairman, W. E. Smythe, Secretary. The local management at Los Angeles is in the hands of a General Committee appointed by the Chamber of Commerce, D. Freeman, Chairman, C. D. Willard, Secretary. Information about the Congress can be obtained from any of the above mentioned parties.

The National Government has given official recognition to the Congress through a Circular addressed to its Diplomatic Representatives in foreign countries. The text of the Circular will be found in the succeeding pages.

DEPARTMENT OF STATE.

WASHINGTON, July 7th, 1893.

To the Diplomatic Officers of the United States :

GENTLEMEN:

At the fourth annual session of the Trans-Mississippi Congress which met at Ogden, Territory of Utah, April 24, 1893, at which all the States of the United States and Territories west of the Mississippi River were represented by regularly appointed delegates, the following resolution, addressed to the President of the United States, was unanimously passed on April 26:

WHEREAS, The greater part of the Trans-Mississippi section represented in this Congress is actively interested in the irrigation industry and in a large measure dependent upon irrigation for the development of its agricultural resources; and

WHEREAS, An International Irrigation Congress is to meet at Los Angeles, California, October 10th, 1893, at which leading irrigationists of the United States, Europe, Asia and Australia will be present, and where a number of important questions relating to irrigation law, irrigation securities, and irrigation methods will receive discussion and action; therefore, be it

Resolved, That this Congress of the Trans-Mississippi States hereby requests the President of the United States to issue an invitation to foreign governments of countries where irrigation is practiced, asking them to send delegates to the International Congress at Los Angeles; and be it furthermore

Resolved, That the Trans-Mississippi States be urged to send representatives to the Congress, and that their respective governments be requested to exert themselves to make the undertaking the success which the dignity and importance of the subject to be considered merits.

The subject of irrigation is one that is rapidly assuming vast proportions in the United States, particularly so far as concerns our large extent of arid lands, and the success which has attended its practice therein has naturally caused its spread throughout the rainy regions of our territory as well.

The congress which it is proposed to convoke at Los Angeles will probably be attended by a thousand delegates coming from all the States of this Union where irrigation is practiced and from foreign countries more or less directly interested in the subject. It promises moreover,

to be an important convention of persons actively interested in the development of the western half of the United States by means of irrigation. The matters to be discussed are of immediate practical interest to the nation and to officers of the government having to do with the public lands and with scientific researches pertaining to the soils and waters of the arid regions. Hence the exchange of ideas of writers on irrigation and others having practical experience with reference to irrigation problems can not but prove highly beneficial to this most important interest not only to our own country, but to all others where irrigation is practiced even to a limited extent.

The interest evinced by the Chamber of Commerce of Los Angeles, California, in behalf of the International Irrigation Congress and by the Chairman of the Committee on Irrigation and Reclamation of Arid Lands of the United States Senate, speaking for the people of all that part of the United States which depends upon irrigation to a greater or less extent, leads the Department to hope for favorable responses from abroad, in order to obtain the fullest possible expressions of opinion on the subject.

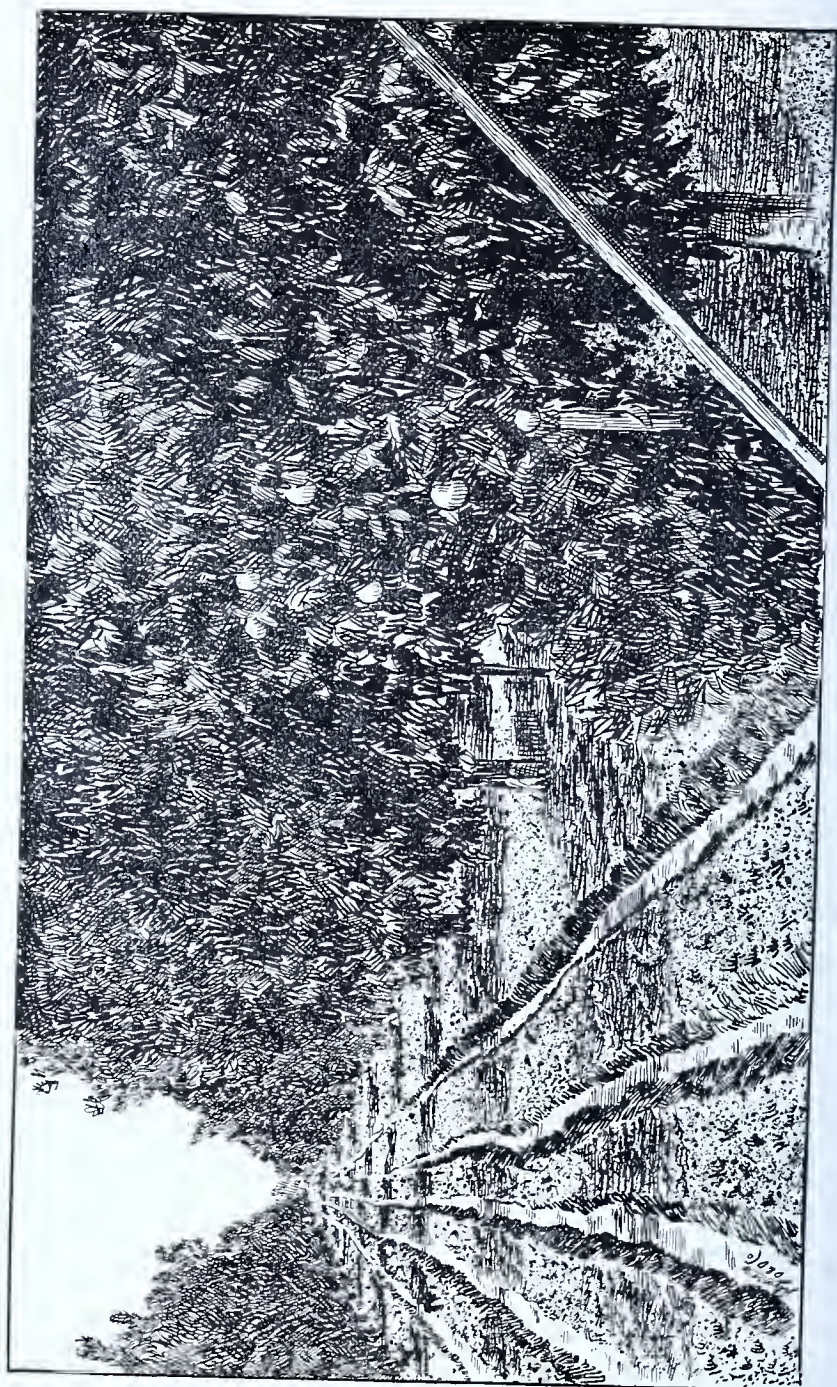
The Department of the Interior will be represented at the proposed meeting by an officer to be detailed by the Secretary of that Department, for the purpose of giving such information as may be desired concerning the results obtained by surveys which have been carried on for several years under the auspices of the General Government.

You are accordingly instructed to informally notify the Government to which you are accredited of this meeting of the International Irrigation Congress, which is to convene at Los Angeles, California, October 10, 1893, and request its co-operation through duly accredited delegates.

I am, Gentlemen,

Your obedient servant,

W. Q. GRESHAM.



ORANGE GROVE AND IRRIGATING DITCHES.

I.

HISTORICAL.

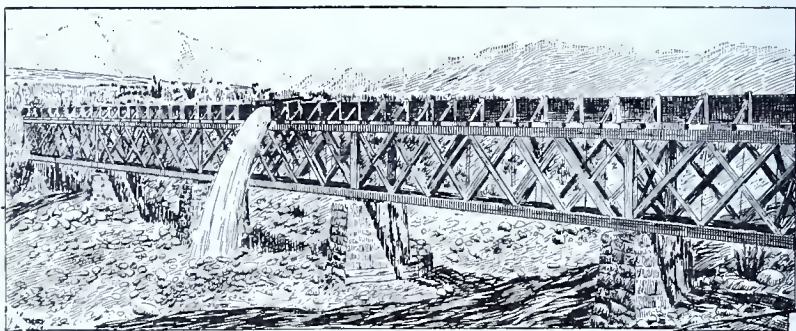
IRRIGATION of land, which to a majority of the American people of today is a new idea, is an art that appears to be almost as old as the culture of the soil by man. It was undoubtedly practiced for many centuries previous to any authentic written history. In the earliest traditions of the Chinese people, which are very ancient, irrigation is mentioned. In Egypt, Syria and the ancient kingdoms of Eastern Asia agriculture depended almost entirely upon irrigation, and still so depends. The bible contains frequent reference to the irrigation of gardens, vineyards and fields.

The earliest agriculture of Europe, Asia and Africa began in arid lands, very similar to those of Arizona, New Mexico and California. In India, irrigation was practiced for many centuries, by utilizing small streams and great rivers. As population increased, the storage of water was introduced. Immense tanks, or reservoirs, and canals appear to have been constructed centuries before the Christian era. In the island of Ceylon alone are 5000 ancient reservoirs. Since the British have had control of the country, irrigation works have been constructed on stupendous plans, and thousands of old reservoirs have been restored. Over \$360,000,000 have been expended on irrigation works, one canal alone costing \$15,000,000.

The remains of reservoirs in Palestine, which are supposed to have been constructed in the days of Solomon, for the supply of Jerusalem, show much engineering skill. The Phoenicians, at the height of their power, were celebrated for their canals. The Greeks, at a very early age, paid great attention to hydraulic engineering. Ruins of large aqueducts are found scattered through Greece. Herodotus describes a conduit three feet wide, which was conducted through a hill in a tunnel a mile long. An-

other masonry aqueduct crossed a ravine 200 feet wide and 250 feet deep, and apparently had the form of an inverted siphon.

Rome, during the reign of Nero, was supplied with water by nine large conduits, having an aggregate length of 255 miles, and delivering over 173,000,000 gallons daily, which amount was afterwards increased to 312,500,000 gallons, or 325 gallons to each inhabitant. The Romans were skilled in hydraulics. All houses had



WASTE GATE IN AQUEDUCT.

siphons, or water pipes. They drained the Pontine marshes, and made all their rivers navigable. In France, Spain, Portugal and other countries which the Romans conquered they constructed great aqueducts, many of which have defied the ravages of time up to the present day. In Spain, irrigation was also practiced by the Moors, and brought to a high degree of excellence.

On the discovery of this continent, the Latin invaders found the natives practicing irrigation on arid lands in Mexico, Peru and the southwestern portion of the United States. Remains of vast irrigating canals and reservoirs in Arizona are believed by some antiquarians to be 10,000 years old. These invaders, who themselves came from an irrigated country, kept up the practice in a small way. It was not, however, until the Mormons emigrated to the arid wastes of Utah that irrigation on a large scale was undertaken by Americans in the United States.

II.

STATISTICAL.

ACCORDING to the latest census, the area of land irrigated in the western part of the United States was 3,631,381 acres, owned by 54,136 farmers, giving an average of 67 acres to each owner. Over half this land was in California and Colorado, and nearly all of the remainder in the Rocky mountain region. Less than 67,000 acres was found in Dakota, Nebraska, Kansas and Texas.

In the census investigation, the following States and Territories are classed as arid regions: Montana, Idaho, Wyoming, Colorado, New Mexico, Utah, Arizona, Nevada, California and those portions of Oregon and Washington east of the Cascade range. Of course, it is understood that all parts of these States and Territories are not arid.

The following table, from the census, gives the number of irrigators and the area irrigated:

STATES AND TERRITORIES.	NUMBER OF IRRIGATORS.	ACRES IRRIGATED
Arizona, - - - -	1,075	65,821
California, - - - -	13,732	1,004,233
Colorado, - - - -	9,659	890,735
Idaho, - - - -	4,323	217,005
Montana, - - - -	3,706	350,582
Nevada, - - - -	1,167	224,403
New Mexico, - - - -	3,085	91,745
Oregon, - - - -	3,150	177,944
Utah, - - - -	9,725	263,473
Washington, - - - -	1,046	48,799
Wyoming, - - - -	1,917	229,676
Sub-humid region, -	1,552	66,965
Total, - - - -	54,137	3,631,381

The total land surface of the arid region is 883,312,000 acres, so that less than one half of one per cent is irrigated. It is estimated that there are 616,000,000 acres of land in this region, upon which water would produce crops.

It is a startling fact, as showing the future importance of irrigation to the United States, that of 568,000,000 acres of vacant public lands in the country, 542,000,000 acres or about 95 per cent, are in the arid region. The other 341,312,000 acres in the arid region are in the hands of individuals, corporations, or otherwise beyond government control. It is estimated that less than nine per cent of the land which is farmed in the arid region is irrigated.

The average value of irrigated lands, including improvements, ranges from \$31.40 per acre in Wyoming to \$150 per acre in California, the general average being \$83.28. The average value of products ranges from \$8.25 per acre in Wyoming to \$19 in California, a general average of \$14.89.

The average first cost of water rights, or of bringing water to the land, is given as \$8.15 per acre irrigated, and the average value of these water rights at \$26 per acre. The average annual expenditure averages \$1.07 per acre, for maintaining ditches, etc. This charge varies widely, running from ten cents to \$5 or more per acre.

The first cost of the systems was \$29,611,000, and the estimated value \$94,412,000, an increase of nearly 219 per cent. The irrigated areas increased in value from \$77,490,000 to \$296,850,000, or 283 per cent.

Small ditches, under five feet in width, have cost \$481 per mile; those of medium size, from five to ten feet in width, \$1628 per mile, and those of ten feet and upward \$5603 per mile, including headworks, flumes, etc.

III.

ADVANTAGES OF IRRIGATION.

THE average profits arising from irrigation, as given in the preceding chapter, appear relatively low. Many individual cases could be cited, especially in regions like Southern California, which are devoted to fruit culture, where the returns have been almost fabulous. Lands that were worth from fifty cents to five dollars per acre have, by the expenditure of ten to twenty dollars per acre in the construction of irrigation works, become worth \$300 per acre and upward. Such lands set out with citrus trees, have, within ten years of planting, sold at \$1000 an acre and more.

The fact that the supply of water in arid regions is artificial is an advantage. An artificial water supply can be regulated, and when the true needs of each cultivated plant shall have been discovered, a uniform maximum of productiveness will be attained, such as is not possible in a region whose water comes directly in the form of rain.

Horticulture is not the only branch of agriculture that is benefited by irrigation. The desirable points of a more certain crop and of a larger yield are just as certainly secured with corn and alfalfa as with oranges and apricots. Stock growing is greatly benefited by irrigation, as pastures are kept green and fresh, and great crops of hay are produced. Alfalfa, the great forage crop of this section, is made to give from five to eight cuttings in a season, which aggregate a tonnage that it would be impossible to secure under ordinary conditions. Almost every product known to our agriculture will not only yield more but will give a greater return above the cost of production.

One of the greatest proofs of the value of irrigation lies in the fact that no farmer who has once practiced it would willingly go to farming in any district where he would have to depend on the natural rainfall. He knows that the labors of half a year will not be rendered void because of a week's drought. The farmer in an irrigated region does not have to wait for rain in order to plow, to sow, or to cultivate. He has the elements and the seasons practically under his control.

IV.

METHODS OF IRRIGATION.

EARLY systems of irrigation in California were naturally of the crudest character. At present the highest engineering skill and large capital are combined to construct works that cost millions of dollars.

The extent and location of the lands to be irrigated must first be determined with approximate accuracy, in order that the money return from the sale of water may be estimated and placed against the cost of obtaining it.

The various hydrographic problems must then be studied in the field, with some degree of detail, including questions of rainfall, storms, evaporation and sediment carried by the water. Detailed topographic surveys are then necessary. If storage reservoirs are to be constructed, an even greater degree of engineering skill may be required. The character and nature of the construction of the dam will differ in every case.

Irrigation is an art that must be learned. It has been brought to the highest perfection in Southern California, by men of means, who have tried all known systems.

Water for irrigation is obtained from running streams; by storing water in reservoirs constructed in the mountains or foothills; by tunneling into the mountains; by building underground dams to force the subterranean flow to the surface, and by boring artesian wells. Water is also occasionally pumped from wells, on a small scale, by windmills or by steam engines.

The first supplies of water used for irrigating were derived from running streams that were easily diverted. No expensive dams or other works were built, and economy in handling the water was not deemed necessary. Such



IRRIGATED CORN FIELD.

streams were not numerous in this section, and over twenty-five years ago successful experiments were made in the search for artesian water. Water storage in natural lakes or depressions, or in reservoirs built on drainage lines, was next undertaken. This system, when the works are judiciously constructed, is the most reliable of all. Several streams of considerable size have been developed by tunneling into the mountains. Where streams have little or no flow in summer, trenches have been sunk to the bedrock, across the stream, and a dam there constructed which has forced the underground flow to the surface.

The next step in irrigation is the application of water to crops. The methods used may all be reduced to three:

flooding, small furrows, and basins, the choice depending upon the soil and the amount of water available. In Southern California the furrow system is now used almost exclusively. It is considered by far the best, as its effect resembles that of a slow, soaking rain. The check or basin system is sometimes used where the surface is rolling or steep. For steep hillsides a method of irrigation by curved furrows has lately been introduced in Southern California. Cemented canals and wooden flumes are largely used. Sub-irrigation has been a total failure practically, the roots clogging the pipes.

The processes of irrigation in Southern California may be classed under three heads: (1) Frequent irrigation with rare cultivation; (2) medium irrigation with medium cultivation; (3) rare irrigation with frequent cultivation. The first may be termed the method of the pioneer, the second the method of experience, the third the method resulting from education. The primitive Mexican farmer wasted as much water in growing a half acre of beans, corn and melons, as is now found ample to thoroughly irrigate twenty to forty acres of oranges or muscat grapes. The change has been brought about by experience, education, and a free use of the cultivator.

The quantity of water used per acre varies greatly. It depends on the crop, the soil, the rate of transpiration, and the judgment of the irrigator. Alfalfa, grown on mesa soils, probably requires the maximum, and olives the minimum. Citrus trees usually require more water than any other trees, and are generally irrigated every four weeks during the summer. The supply of water per acre, varies in the different colonies. At Ontario, Pomona, and Cucamonga one inch to ten acres is stipulated; Rialto, Redlands and the proposed Victor project, have one inch to eight acres; Riverside, Santa Ana, Highlands,

and several other settlements use any amount which the irrigator chooses to order and pay for. Some districts are contracting to furnish one inch to five acres.

The term here used in water measurement, one inch, means a steady flow of water through an aperture one inch square, under a four inch pressure, and is identical with the term "miner's inch" as commonly used in California. This flow yields in round numbers 9 gallons per minute.

The preparation of virgin soil for an orchard or vineyard to be irrigated after planting, varies little from that of land which depends on rainfall. If the soil is light and porous it is desirable to have quite a fall to the land so that water in the furrows may be run swiftly over the soil, while on a heavy soil it is necessary to have the ground nearly level so that the water may be run very slowly, thus thoroughly soaking the ground. Trees are usually planted twenty, twenty-two and twenty-four feet apart. Furrows are commonly opened between these trees by taking off the teeth from a six-foot cultivator and placing a small shovel at each end and one in the center, thus making three furrows, each two feet apart, at one trip. The growing limbs usually extend so far out from the trees that two sets of furrows are all that can be made. Into these six shallow furrows the water is turned from the flumes or head ditch and is allowed to run twenty-four to forty-eight hours, according to the nature of the soil, until the ground is perfectly soaked. The cultivator is started as soon as the horses can get on the ground after the irrigation and the soil is kept perfectly pulverized until another irrigation is deemed necessary.

In Southern California, orange trees are usually irrigated about six times annually, apricots, peaches, prunes and muscat (raisin) grapes three times, and olives and corn once, while alfalfa is generally flooded after every cutting, which is from six to eight times every season.

Irrigation for grain is never resorted to in Southern California, the "glorious climate" making it possible for the grain farmer to plow in December, sow in January and harvest in May, the usual winter rains from December to April being ordinarily amply sufficient to make a first-class crop of wheat or barley. Sugar beets are not irrigated.

V.

WHAT WATER HAS DONE.

WITHOUT exaggeration, it may be said that no other element has done more than the practice of irrigation to build up the wealth and population of this State, and especially of Southern California, while it is equally certain that the progress of the past is but a mere indication of what will be accomplished during the next few years.

Irrigation has wrought changes here more rapid and radical than any before seen on earth. Within the past twenty-five years, it has reclaimed what seemed to many a hopeless desert, and has made the most prosperous part of the State of what was then sneeringly referred to by our brethren of the north as the "cow counties." It has reversed all land values and standards of value; taught that there is no such thing as poor land, if it is warm, well drained and can be irrigated, and has developed possibilities in fruit culture and general tillage that would otherwise have lain for ages unsuspected and unutilized. Southern California proves conclusively that, on all land sufficiently well drained to be available for trees, vines, or other valuable crops, in seasons of excessive rain, whatever may be done without irrigation may be doubled, tripled, or even quadrupled, with it. In some places, in this section, three crops a year are raised for several seasons in the young orchards, making practically four crops a year.

Irrigation has here made a country such as can be seen nowhere else, which supports in comfort, and even luxury, more people to the acre than the soil supports in any other country peopled by the Anglo-Saxon race. Division and sub-division is the rule, instead of the steady



CANAL BETWEEN DESERT AND ORCHARD.

increase of large farms. Ten acres of land is enough to keep anyone busy, if properly worked. Street railroads, cement sidewalks, and many other improvements are seen years before they are thought of in settlements of the same size elsewhere, and the banks probably have more money on deposit than in any other working community of like size on earth. Without exception, wherever irrigation enterprises have been inaugurated, there has been a rapid growth in both population and wealth. On the other hand, with few exceptions, the unirrigated sections of the State have stood still or actually retrograded.

Nothing can better illustrate the effects which irrigation has had upon the growth and development of Southern California than a comparison of the condition of two sections of the State in 1870 and in 1890, as shown by

the census returns. The seven counties of California in which irrigation is largely practiced show a population as follows :

	1870	1890
Fresno, - - - - -	6,336	31,877
Kern, - - - - -	2,925	10,031
Los Angeles (inc. Orange),	15,309	114,974
Merced, - - - - -	2,807	8,162
San Bernardino, - - - - -	3,988	25,486
San Diego, - - - - -	4,951	34,878
Tulare, - - - - -	4,533	24,875
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Totals, - - - - -	40,849	250,283

For the purpose of comparison, we select seven counties of Central and Northern California in which irrigation is not practiced, and which had, in 1870, a population slightly in excess of the seven irrigating counties:

	1870	1890
Alpine, - - - - -	685	667
Calaveras, - - - - -	8,895	8,970
Del Norte, - - - - -	2,022	2,570
El Dorado, - - - - -	10,309	9,206
Marin, - - - - -	6,903	12,613
Mendocino, - - - - -	7,545	17,573
San Luis Obispo, - - - - -	4,772	16,179
	<hr/>	<hr/>
Totals, - - - - -	41,131	67,778

It would be absurd to claim that the remarkable difference in the growth of the population in these two sets of counties is attributable to chance. It is due almost entirely to "Irrigation—Science, not Chance."

The increase in wealth, as shown by the assessed valuation of these two sections, is still more marked. In 1870, the seven non-irrigated counties named above were assessed at \$12,550,341, and in 1890 they had increased in valuation to \$45,039,322. In 1870, the seven counties practicing irrigation were assessed at \$22,513,820, and

in 1890 this had increased to the enormous total of \$207,216,567. A contemplation of these figures will better show the wonderful growth of the irrigated over the non-irrigated section than any words could do.

During the past ten years, California has gained at the rate of 39 per cent. in population. During that period, thirteen counties of the State have lost in population from 1 to 13 per cent., while fifteen, including the most important irrigated areas, have grown more rapidly than the State at large. The seven counties of Southern California increased their population from 64,378, in 1880, to 202,974, in 1890. The counties in Northern and Central California, which have maintained and increased their population, will also be found to have been favorably affected by the tendency that irrigation has developed.

Let us now glance at some of the actual results of irrigation in Southern California. The oldest irrigated settlement of importance in this section is Anaheim, which is called the mother colony of Southern California. In 1857, fifty residents of San Francisco, of German descent, united to buy a tract of 1,165 acres of land on the then uncultivated and apparently desert plain southwest of Los Angeles. The price paid was \$2 an acre, and included with the land was a right to water for irrigation. The members of the colony were workmen of almost every occupation, except farmers. None of them had money enough to buy and improve a small tract, but they believed that by co-operation they could better their condition. The tract was divided into fifty twenty-acre lots, with a village plot and lots for schools, churches, etc. A competent manager was chosen and the members assessed themselves at first for just enough to pay for the land. An irrigating ditch, seven miles in length, from the Santa Ana river, was constructed.

Vines and fruit trees were planted, and in three years were bearing fine crops. The colonists then came to take possession of their lands. Each stockholder had paid in \$1,200, the actual cost of twenty acres. Premiums for choice lots reduced the average to \$1,080. To-day, many of these twenty-acre tracts, which cost \$1,080, are worth from \$5,000 to \$10,000, and some of them, which are now a portion of the city of Anaheim, are worth, unimproved, ten times as much. Now, about one thousand carloads of farm products are shipped annually from Anaheim. There are fine churches and schools, an opera house and hotels, a large brewery, fruit dryer, grist mills, planing mills, brick yards, bank, newspapers, and a number of stores. All this has been accomplished by poor men, starting in without experience, upon an arid waste.

A still more striking instance of the marvelous transformation effected by the marriage of water to arid land in this section is furnished by Riverside. In 1871, that locality was a barren, desolate plain, without house, fence, tree, or even brush, and with a solitary sheep-herder to represent the population. The tract was assessed at 75 cents per acre, and the owner appeared before the county Board of Equalization to have his assessment reduced, claiming that it was higher than the actual cash value of the land. In the face of many obstacles, water was brought upon this arid plain from the Santa Ana river. Note the results:

Last season, Riverside shipped about two thousand, five hundred carloads of oranges, worth, on an average, \$500 per carload. There are nearly ten thousand acres of orange groves within a radius of a few miles. Riverside is said to have a greater per capita wealth than any other city in the United States. The banks, during the past year, have carried average deposits of \$1,200,000.

The population in 1890 was 4,683, and is now little short of 7,000. The assessed valuation of property is nearly \$6,000,000. Thirty-one teachers—almost all college graduates—instruct 1,300 pupils. The public school buildings cost \$135,000. There are fifteen church organizations, with 2,675 members and \$140,000 worth of property. The Y. M. C. A. has a \$25,000 home and 215 members. There is a free public library, with 6,000 volumes. The opera house cost \$117,000. There are several fine hotels. Buildings to the value of \$1,000,000 were erected last year. Magnolia avenue is 150 feet wide, twelve miles long, and bordered for miles with handsome shade trees. There are a dozen fruit packing houses. Besides the orange groves, there are over 1,200 acres in raisin grapevines.

Take Pasadena: In 1874, a syndicate known as the Indiana colony purchased the San Pasqual rancho, the site of what is now Pasadena, at \$5 an acre. The owner's conscience afterwards smote him at having sold to the "tenderfeet" at so outrageous a price. Water was brought on the land from the mountains, and trees and vines planted. And to-day:

The census of 1890 gave the city of Pasadena a population of 4,882. Including the suburbs, which extend in all directions, it now has a population of nearly 10,000. It has well paved streets, handsome business blocks, large and tasteful churches and school buildings, an imposing library, spacious opera house, daily and weekly newspapers, and several banks. The numerous beautiful homes, in attractive grounds, are the admiration of all visitors. Two railroads connect the city with Los Angeles and an electric road is projected. The sheep pasture of 1874 furnishes California with the present Governor of the State.



DIVERTING DAM.

We can only briefly refer here to the numerous other magnificent settlements in Southern California, made possible by the free use of water, combined with brains, courage and money. Pomona and Ontario, created from arid plains and the waters of the San Antonio Canyon; Redlands, Highlands, Alessandro and adjacent fruit groves under the Bear Valley system; Chula Vista, the lemon grove of San Diego county, and the other beautiful places now growing under the Sweetwater dam; the magnificent San Jacinto plains, which are being rapidly transformed into a garden by the water supply of the Hemet dam.

Such are a few of the monuments which have been erected to irrigation in Southern California during the past twenty years. Did space permit, the list might be increased tenfold. But enough has been said to show the wonders that irrigation has already worked during the brief space of time.

VI.

IRRIGATION SYSTEMS OF SOUTHERN CALIFORNIA.

FIVE of the seven counties of Southern California are the only ones in which irrigation is practiced to any extent. In Ventura and Santa Barbara counties, owing to propinquity to the ocean, almost all varieties of crops have hitherto been raised without irrigation. A beginning has, however, been made in that direction, and there are projects under consideration for the construction of systems that will supply large areas in the interior of these counties with water.

Southern California is one of the pioneer irrigation sections of the United States. Irrigation has been practiced here ever since the founding of the missions. Crops were raised by irrigation in Southern California, under the direction of white men, before the Declaration of Independence was read. One of the first things to be done by the priests, when a mission was established, was to construct an aqueduct, or *acequia*, for the purpose of conveying water to the growing crops and the orchard and vineyard, that were planted from seeds and cuttings brought from Mexico. Ruins of the old systems, built by the Indians under direction of the priests, may yet be seen about some of the old missions. There is no proof that irrigation was practiced by prehistoric races here, as was the case in Arizona, except, perhaps, in a few valleys near the Arizona line.

For many years, there was no attempt to improve on the primitive irrigation methods of early days. Settlement was sparse and water plentiful, for the small area which was cultivated. Instead of regulating the flow by furrows or otherwise the land was simply flooded, and

there was, naturally, much waste. This undoubtedly led to the early decay of the mission orchards and vineyards. It is within the past twenty years that all the important irrigation enterprises of Southern California have been established, while most of them have been in operation less than half that time.

The area available in the seven southern counties, not including what is known as the desert region, that may be cultivated for fruit by means of irrigation is not less than 3,000,000 acres. Plans now under way for the reclamation of the so-called "desert" will largely increase this area. At an average profit of only \$100 per acre, in fruits and other special crops, the reclamation of these 3,000,000 acres would, within five years, yield an annual income of \$300,000,000.

In 1890 the area of land irrigated in the five counties of Los Angeles, San Bernardino, Riverside, Orange and San Diego was estimated at 150,000 acres, or nearly 5 per cent of the area available for horticulture outside of the desert region. Since then the area has increased at least one-third, but it still represents a very small percentage of the arid land that may yet be transformed into flourishing orchards and vineyards, supporting a dense population of prosperous horticulturists. There are about 300 different systems of irrigation works in these five counties.

LOS ANGELES COUNTY.

The irrigable portions of Los Angeles county are embraced in the San Gabriel, Pomona, San Fernando, Los Nietos and Antelope valleys, and the coast plain region.

The San Gabriel valley varies in elevation from 625 to 1700 feet above the sea. Together with its mountain and hillside catchment areas, the valley embraces a terri-

tory about 560 square miles in extent. About 100,000 acres in the valley are highly cultivatable and productive under irrigation. There are noteworthy irrigation systems at Pasadena, Monrovia, Duarte, Azusa and Glendora. After the San Gabriel river is crossed, beyond Azusa, more difficulty is experienced in securing water. Many land owners around Glendora have their own private water supply for irrigation, obtained from tunneling into the mountains.

The Vineland irrigation district, near Azusa, comprises 4000 acres, has an assessed valuation (December 1892) of \$221,000; voted \$62,000 bonds, of which \$40,000 had been sold for cash and \$14,000 traded. The bonds have been confirmed. This was the first District organized under the Wright Act in California.

The San Gabriel valley, as a whole, probably receives 50 per cent greater rainfall than does that of San Fernando, and 80 to 90 per cent more than the valley of San Bernardino. This is because there is no high mountain range in front of the valley.

The flourishing horticultural city of Pomona with its adjacent colonies is mainly supplied with water from an interesting system of artesian wells, of great volume, and also from one-half the surface flow in San Antonio creek, the water being of remarkable purity. There is an irrigation district known as the Pomona Orange Belt, containing 4000 acres, assessed at \$400,000, and with \$200,000 bonds voted, which have been confirmed.

The Santa Gertrudes district, in the plain region of the county, with headquarters at Santa Fe Springs, embraces 2000 acres.

At Whittier, the East Whittier Water Company brings pure water nine miles, in iron pipes, from artesian wells near El Monte.



ARTESIAN WELL AT POMONA.

The San Fernando valley occupies the western portion of the Southern California basin. It contains about 570 square miles, of which over 100,000 acres are really good irrigable lands. The rainfall in the valley is only about 11 inches. The great Porter ranch, on which is the San Fernando mission, is supplied with water from artesian wells, which are capable of much greater development. At Pacoima is an underground dam, built for the purpose of forcing the water of a stream to the surface. A defect in its construction permitted water to seep through. Above Chatsworth Park, near the Simi Pass, are several large reservoirs.

The watershed of the Soledad Dam and Storage Reservoir Company, incorporated, is located south and east of

Acton, 28 miles north of Los Angeles. The area is 138 square miles, mostly timbered; elevation from 3000 to 6500 feet, portions being covered with snow most of the year. Estimated flow of watershed 6750 miner's inches, during entire year. The district is within a forestry reservation. Two reservoir sites have been allowed by the government. One, of 400 acres, will hold nine billion and the other 200 million gallons, together about one-fourth the available supply. Part of the dam for the smaller reservoir has been built. A pipe line $22\frac{1}{2}$ miles long will convey 2500 inches of water to the San Fernando valley.

The Antelope valley, a great elevated plateau, which until recently was only known as a portion of the Mojave desert, is coming to the front as a horticultural region, and several irrigation districts have been established. There is an artesian belt 30 miles wide, within which flowing water may be obtained at a depth of about 100 feet. The Big Rock Creek district, with headquarters at Solano, includes 30,000 acres, voted \$400,000 bonds, confirmed, of which \$150,000 has been traded. The Manzana district embraces 2400 acres, with an assessed valuation of \$75,000. It is a colony chiefly devoted to almond culture. Little Rock Creek district has 2000 acres.

Toward the ocean, near Long Beach, there are flowing artesian wells of great volume. Besides the systems mentioned, much water is obtained for irrigation by tunnels and pumping from wells by means of gasoline engines and windmills. There are about 700 artesian wells in the county.

The city of Los Angeles takes its water supply for irrigation from the Los Angeles river. The amount required is constantly diminishing, as orchards and vineyards are cut up into building lots. There are over 50

miles of conduit, of which about half are flumes, pipe and culvert. Forty miles of ditches outside receive their supplies from the city. The irrigation system of Los Angeles, within the city, is under control of the city council, and in charge of a *zanjero*, or ditch overseer. Irrigators within the city can now have all the water they require by paying for it. Sewage is used for irrigation in Vernon district, just south of the city. The area irrigated by this municipal system is about 12,000 acres, of which nearly one-fourth is within the city limits.

SAN BERNARDINO COUNTY.

Mounts San Bernardino, San Jacinto and San Antonio, are the culminating points in the topography of Southern California. From them extend the San Diego ranges, southeast into Mexican territory, and the Sierra Madre ranges a hundred miles through Los Angeles into Ventura county. These mountain masses play an important part in regulating the irrigation water supply of Southern California.

The effect of an intercepting mountain range upon rainfall is most distinctly marked in this region. The clouds, drifting inland from the sea, break on the summits and precipitate their contents. They cover the crests with snow and send great rains down the western slopes in heavy torrents. While the valley has a rainfall of barely 8 inches, the mountain peaks and spurs receive from 50 to 100 inches.

The Santa Ana river, with an independent mountain area drainage of 220 square miles, is the main surface drain of this irrigable region, and also its chief irrigation feeder. There are some twenty smaller and tributary creeks, canyons or washes. The northern face of the range is drained by the Mojave river, with a basin slope

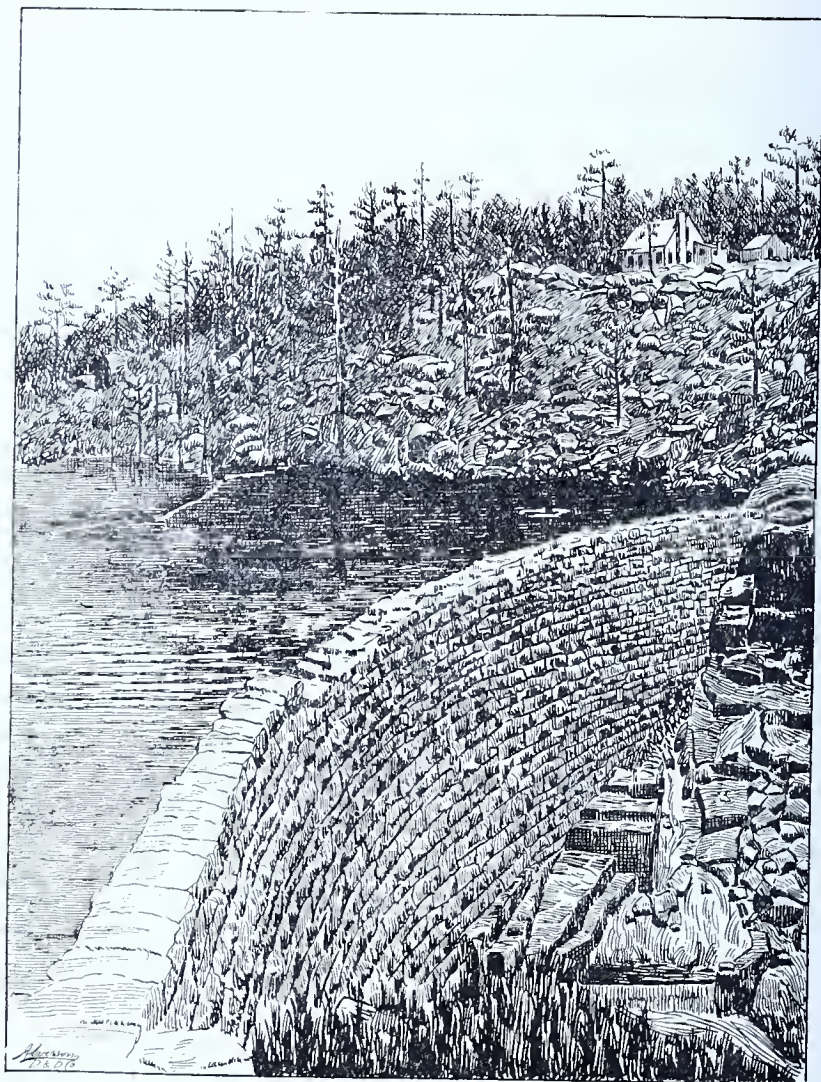
from east to west of 120 square miles. At present it is lost in the sandy waste 40 miles from its source, but a project is on foot to utilize its flow, as is noted further on.

The topographical features of the San Bernardino basin, with its great slopes ranging from 30 to 120 feet per mile, compels the grouping of irrigation works and areas deriving their supplies from limited and distinct sources, three from the Santa Ana river, four from mountain canyons, and others by means of artesian wells or tunnels driven into the mountains, of which there are many.

The Bear valley system stands preeminent, both as regards engineering skill and the appreciation of land values through its construction. The system is without a superior in the state, or perhaps in the world. It presents one of the best examples possible of the results that have followed the union of land and water in this section.

Ages ago, there was a lake in the fastnesses of the San Bernardino range, fed by melting snows and the heavy rainfall. Some convulsion of nature rent the mountain walls and let the water into the valley beneath. The lake became a beautiful little valley with grassy meadows. Frank E. Brown, a young man recently from Yale college, saw the possibilities of this old lake bed. In the face of much discouragement, a convex wall of stone was built across the river chasm. The waters accumulated, and when the wall was completed the lake was restored.

The watershed of the reservoir has an area of 77 square miles, or 49,280 acres, sufficient to irrigate, in an average season, over 250,000 acres. One foot of rainfall will put 49,280 acre feet of water in the reservoir, not allowing for wastage, and will more than fill the present reservoir. Water lost by evaporation and seepage is compensated for by drawing supplies during winter and spring from the Santa Ana river.



BEAR VALLEY DAM.

The dam has stood a fall of 30 inches of water in 37 hours. Its height is 60 feet. So successful has the enterprise been, and so great is the demand for water, that work is now proceeding on a new dam 120 feet in length, just below the present one. When completed, the Bear valley reservoir will hold 461,660 acre feet of water, sufficient to irrigate 300,000 acres through two dry seasons.

The company's water is distributed by main canals and pipe lines, nearly 100 miles in length, to the Redlands, Highlands, North San Bernardino, Alessandro and Perris districts, where it is further distributed in laterals. Many of the mains are 24 to 28 inch steel pipe.

Another improvement now under construction by the company is the Santa Ana canal, along the north side of the canyon, through long tunnels into the reservoir. As an irrigation work this is unique, being practically a mountain construction for most of its length. This canal will largely increase the water supply of the system.

The Bear Valley Irrigation Company is the strongest combination of capitalists today operating in Southern California. Its property is worth about \$5,000,000.

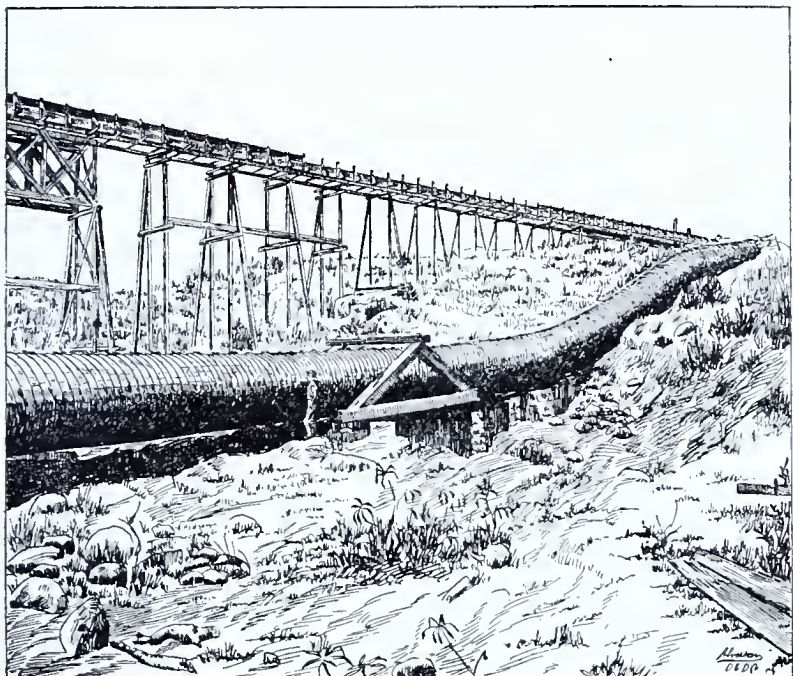
Another great irrigation enterprise, now under construction, is that of the Arrowhead Reservoir Company, organized by Cincinnati people, with a capital stock of \$1,000,000. This system is also a unique and bold one, as it takes its supply from the mountain watershed on the north side of the range, the water being conducted through the mountains in tunnels several miles in length, six feet wide by six and one-half feet high, driven through granite.

The drainage area of the system is 78 square miles, at an elevation of 4000 to 7000 feet. A series of reservoirs will be built in natural valleys, with a total storage capacity of 112,500 acre feet. The distance from the first reservoir to the valley is $15\frac{1}{2}$ miles, of which $5\frac{3}{4}$ miles are canal, $5\frac{1}{4}$ miles flume, $2\frac{1}{4}$ miles tunnel, and $2\frac{1}{4}$ miles natural bed of a rocky canyon, where the stream will be available for electrical power. From this point, the water will be carried by a main distributing canal westward along the base of the mountains, at a sufficient elevation to cover all the agricultural land in the San Bernardino valley not already supplied. Construction is

in progress on a masonry dam and two tunnels, one of which is about a mile in length. One of the best constructed and most picturesque mountain roads in California, 15 miles in length, with no grade over 12 per cent, has been built by the company into Little Bear valley, by way of Waterman canyon.

The Rialto irrigation supply is from Lytle creek and artesian wells. Cucamonga has an abundant supply from tunnels and artesian wells on water bearing lands west of the colony. There are 45 miles of pipe line, conveying the water under pressure. The source of supply for Ontario is San Antonio creek, flowing from the San Antonio canyon. The supply is largely increased by a tunnel into the gravel and boulders of the canyon bed, a distance of 2850 feet. This tunnel was constructed several years ago and was run in such a manner as to tap the enormous underflow which was believed to exist in that canyon, and the projectors were correct in their belief for this tunnel has now furnished a steady flow of water for many years. The remainder of the underflow from this canyon, the largest in Southern California, supplies the artesian wells at Pomona and furnishes abundant moisture for the damp lands of the famous Chino valley.

A daring project is that of the Victor Irrigation Company, which proposes to impound the waters of the Mojave river, by building a dam at the upper narrows, just south of Victor, on the northern slope of the San Bernardino mountains, where there is a flow of 13,000 inches in a dry summer. The dam will be 140 feet long at the base and 150 feet high, forming a lake 7 miles long. The watershed is from 3000 to 6000 feet above sea level, with an annual rainfall of from 20 to 60 inches, and will, it is claimed, furnish sufficient water to irrigate 200,000 acres, on a basis of one inch to five acres. This system differs



ABANDONED FLUME AND NEW PIPE LINE.

from others in Southern California, in that water can be turned into the canals without a reservoir, by simply putting in the foundation for a dam and diverting the waters of the river with the underflow.

The following irrigation districts have been formed under the Wright Act in San Bernardino county:

Citrus Belt; headquarters Rialto; 12,000 acres; assessed valuation \$622,722; bonds voted \$800,000; bonds confirmed.

Grapeland; headquarters Grapeland; 10,787 acres; assessed valuation \$464,925; bonds voted \$200,000, traded \$35,700; confirmed.

Rialto; headquarters Colton; 7200 acres; assessed valuation \$534,360; bonds voted \$500,000; traded \$500,000; confirmed.

RIVERSIDE COUNTY.

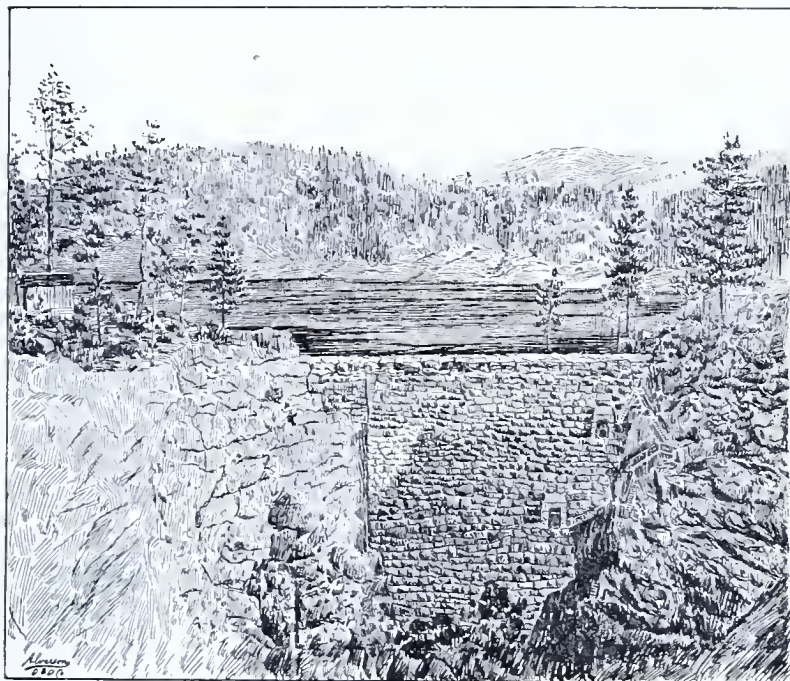
The Riverside colony enterprise, now the beautiful city of Riverside, and county seat of the recently formed county of that name, first brought the great advantages of irrigation to the attention of the people of California on a large scale.

The works of the Riverside Water Company, whose supply is considered as ample and secure as any in the State, consist of three main canals and diversions, an extended irrigation distribution system, and a main pipe line and branches for the delivery of water, chiefly for domestic purposes. The supplies are derived from the Santa Ana river and Warm Creek, and from an extensive system of artesian wells. There are over thirty-three miles of main canals, and fifty of laterals. The land and water supply go together. Water for irrigation is delivered on the highest corner of each ten-acre lot, at an average expense of \$6 per acre per annum.

The next most extensive and important system of canals in Southern California is that organized and constructed by Matthew Gage, for use on the Arlington Heights tract, adjoining Riverside. The supply is taken from artesian wells and the Santa Ana river. The entire area irrigable from the system is 12,000 acres. On the Victoria tract, two and a half miles southeast of San Bernardino, are some forty artesian wells, from 150 to 500 feet, to supply this system.

West Riverside is supplied with water from the underflow of the Santa Ana, taken by submerged flumes sunk under the bed of the river near Colton and conducted twelve miles by a canal which runs through two tunnels, each 3,000 feet long.

What many engineers consider the best built dam in America has recently been constructed, 4,500 feet above



LAKE HEMET DAM.

the sea, in the San Jacinto mountains. The Hemet dam is in a very narrow gorge of solid rock and is built of blocks of granite of from three to five tons each, no small stones being used. The spaces between are filled with rich concrete, mixed by machinery, and rammed into place with steel rods. It is at present finished to a height of 110 feet, forming a lake two miles long, with an area of 750 acres. When finished, it will be 160 feet high, with a capacity of 11,000,000,000 gallons. The watershed contains over one hundred square miles, with an average rainfall of forty-five inches. The water will be used upon the mesa in San Jacinto valley.

Perris has a good supply, brought twenty-eight miles in 30-inch iron pipe, from the Bear Valley system.

East Riverside is supplied from wells bored in a body of damp land full of springs, five miles northwest of Colton. A system of pipe line, already in existence, was purchased and lengthened.

The following irrigation districts have been formed in Riverside county, under the Wright Act:

Alessandro; headquarters, Moreno; 25,500 acres; assessed valuation, \$2,493,029; bonds voted, \$765,000. These bonds were traded and have been confirmed.

East Riverside; headquarters, Colton; 3,600 acres; bonds voted, \$250,000, of which \$100,000 have been sold for cash. Bonds confirmed.

Olive; headquarters, Riverside; 1,280 acres.

Riverside Heights; headquarters, Riverside; 3,500 acres; assessed valuation, \$344,625.

Elsinore; headquarters, Elsinore; 11,300 acres; assessed valuation, \$402,175; bonds voted, \$452,000. This district was abandoned, as the courts declared it illegally organized.

Murrieta; headquarters, Murrieta; 15,600 acres.

Perris; headquarters, Perris; 13,422 acres; assessed valuation, \$624,054; bonds voted, \$442,000; sold for cash, \$74,500; traded, \$240,000. Confirmed.

San Jacinto and Pleasant Valley; headquarters, Winchester; 18,000 acres; assessed valuation, \$603,337; bonds voted, \$350,000; sold for cash, \$190,000; traded, \$160,000. Confirmed.



ORANGE COUNTY.

Orange county is well supplied with water for irrigation. The Santa Ana river flows across the entire width of the county. Ordinarily, all the water is diverted from the channel to supply the numerous irrigating ditches that make a network over the county. The Aliso, Santiago and Coyote are streams of respectable size, used for irrigation. There are more than a thousand flowing artesian wells; in depth from 35 to 250 feet. In the several irrigation districts there are over seventy-five miles of ditches.

The Anaheim system, established thirty-five years ago, when irrigation was somewhat of a novelty to Americans, has since been much improved and extended. An irrigation district, embracing 32,500 acres, with an assessed valuation of \$1,245,742, has been formed, under the Wright Act. Bonds to the value of \$600,000 were issued, and \$300,000 sold for cash.

What is stated to be the greatest siphon for irrigating purposes in the world was recently completed, about a mile above Olive, between Orange and Riverside. A mountain spur was pierced by a tunnel 750 feet long and seven feet wide, lined with concrete. The discharge, at full capacity, is 120 cubic feet per second. The water is taken from the Santa Ana river, and is first utilized as power in a flour mill.

Work is progressing on a submerged dam in Santiago Canyon, to supply water to the great San Joaquin ranch of 100,000 acres. The dam will be about three hundred feet wide by sixty-five feet in height, with a flood dam above, forming a reservoir nearly two miles in length. The water will be conducted to the ranch through a tunnel over three thousand feet long.

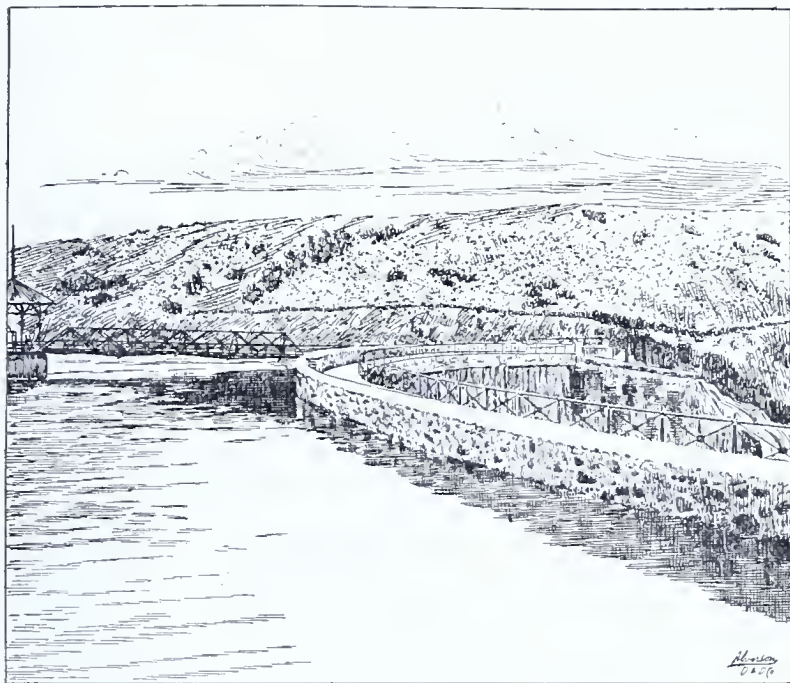


CONDUIT FROM LAKE HEMET DAM.

SAN DIEGO COUNTY.

San Diego county has only recently commenced to develop the vast resources of its "back country" by means of irrigation. A large portion of the county consists of that remarkable arid area, the Colorado desert.

The county is divided into three rainfall belts, according to elevation. In the mountain region the fall is often very large, with some snow in winter. The reclamation of the irrigable territory of the county, comprising over 450,000 acres, depends on the success with which streams and storm supplies may be conserved by extensive reservoir systems.



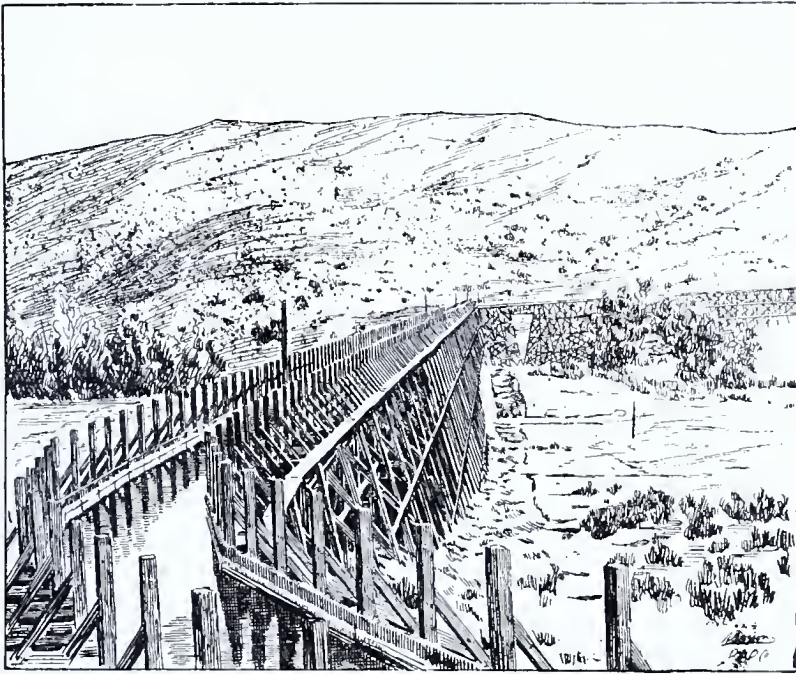
SWEETWATER DAM.

The Sweetwater dam, built across the mouth of a canyon a short distance above National City, is one of the boldest pieces of engineering in the world. The dam is constructed as a crown arch, and is the largest of its character in the world. It is of solid granite and Portland cement, 46 feet thick at the base and 12 at the top. It is 90 feet high at bed-rock, 76 feet long at the base and 396 feet at the top. The reservoir covers 700 acres, and has the enormous storage capacity of six billions of gallons. The water is discharged from the reservoir by means of a main pipe 35 inches in diameter, and then by smaller pipes. Much of the land under this system is high and rolling, but the head is sufficient to carry the water to the highest portions. The dam gathers the

rainfall from 186 square miles, and the capacity of the reservoir is sufficient to hold a two years' supply for 10,000 acres.

One of the most difficult irrigation enterprises in the State to construct was that of the San Diego Flume Company, which brings water 55 miles through a mountain country, on an even grade. The headwaters of the system are in the Cuyamaca mountains, 4,500 feet above the sea, where a dam 720 feet long and 35 feet high impounds a lake of pure water, covering 900 acres. Thence, the water dashes twelve miles down a rocky gorge to a diverting dam, where the long journey through the six-foot-wide flume commences, over deep gorges and through wild mountains. In the journey, 325 trestles are crossed, several of which cost \$25,000 apiece. One is 1664 feet long and 70 feet high. Nine tunnels aggregate a mile in length. The system has cost \$1,500,000. Water is sold at the low rate of \$300 per inch.

Perhaps the most remarkable irrigation enterprise ever projected in the United States is that of the Colorado River Irrigation Company, incorporated at Denver in 1892 to reclaim lands in Mexico and the United States. If the company carries out its programme it will reclaim a large portion of that now forbidding waste, the Colorado desert, some of which is 200 feet below sea level. Extensive surveys have established the feasibility of the project, and work is to commence this fall. The system of canals will cover about 800,000 acres of rich sedimentary lands in San Diego county. The headgates will be in rock, on the west bank of the Colorado river, about nine miles above Yuma, the head of the canal being ten feet below low water. No dam will be required. The main canal will be 120 feet wide on the bottom, with a capacity of 3,500 cubic feet per second. Water will eventually be



SAN DIEGO FLUME COMPANY TREESTLE.

carried as far as Indio, a distance of 147 miles. It is expected that water will be on the lands by March, 1895.

There are a number of smaller irrigation enterprises in the county, besides those mentioned, and several projects of magnitude are under consideration.

The following irrigation districts have been formed in San Diego county, under the Wright Act:

Escondido; headquarters, Escondido; 12,814 acres; assessed valuation, \$650,000; bonds voted, \$450,000.

Fallbrook; headquarters, Fallbrook; 12,000 acres; assessed valuation, \$426,545; bonds voted, \$400,000.

Linda Vista; headquarters, San Diego; 42,000 acres; assessed valuation, \$515,340; bonds voted, \$1,000,000; traded, \$160,000. Confirmed.

Jamacha; headquarters, San Diego; 22,000 acres; assessed valuation, \$830,000; bonds voted, \$700,000; traded, \$165,000. Confirmed.



IRRIGATED ALFALFA FIELD.

KERN COUNTY.

The largest individual irrigation system to be found in Southern California in respect to the amount of water employed and the territory covered is that of the Kern County Land Company. The water is from the Kern river and is taken out through 27 main canals of which the largest is 120 feet wide on top and 80 feet wide on the bottom and 6 feet deep. The system contains 300 miles of main canal and 1100 miles of lateral. The expenditure to date is nearly \$4,000,000. The territory covered is 600,000 acres. The county is settling up rapidly and the land is being set to orchards and vineyards and used for alfalfa growing and general farming.

VII.

THE WRIGHT ACT.

AS the practice of irrigation assumed greater importance in California, all the easily available sources of supply were utilized, while there still remained many millions of acres of land needing irrigation. To provide such lands with water involved the expenditure of vast sums, far beyond what private capital could be induced to invest. Storage reservoirs were seen to be a necessity, while the construction of expensive systems of canals was needed to cover the vast area of arid lands that could only be made productive through the aid of irrigation.

Various suggestions were made to meet the emergency, which finally took shape in the passage of the measure known as the Wright Irrigation Act. This law has stood the test of the courts, has been pronounced constitutional by repeated decision, and is regarded as an epitome of knowledge on the subject. The law provides for a district system of organization, by which the people in any given section, the lands of which are irrigable from a common source, may form an irrigation district similar to a municipal corporation, a city or county. Having determined upon the source of supply and the most feasible manner of constructing the necessary works, estimates are made of the cost of such works, and the people interested are empowered to vote bonds to defray the cost, the bonds being a first lien upon all the property in the district to be benefitted, and the payment of interest thereon and their redemption to be made through taxes regularly levied and collected, in the same manner as in the case of city or county bonds.

Each district has a board of directors, whose office is to manage and control the affairs of the district in substantially the same manner as a board of supervisors manages the affairs of the county. There is provided an assessor, a collector and a treasurer with like powers to those of the corresponding officers of a county.

The single purpose of the organization is the irrigation of all lands within the district. A competent engineer is employed to determine on the best possible system and its cost. The engineer's report is passed upon by the board. If adopted, they submit to the electors of the district the question whether bonds to the necessary amount shall be issued. These are then sold, and the proceeds applied to the construction of the works, under the system of competitive bidding, the successful bidder to give an ample bond.

Thus, the district acquires the water at bare cost. The land owner is not subject to annual exaction from those who deal out water as an article of merchandise, and is not subject to the liability of failure to get it at all, in consequence of the inability or disinclination of the seller to fulfill his contract. In other words, the land owner, by this plan owns the water. It becomes an appurtenance of the land.

Several modifications of the law, the desirability of which had been taught by experience, were passed by the recent legislature, among others a mortgage bill, permitting districts to raise money on their property, an exclusion bill, permitting portions of a district to secede therefrom, and a disorganization bill, for the winding up of districts, under certain circumstances.

There have been some forty districts organized in the State, so far, under the provisions of the Wright Act.

VIII.

IRRIGATION SECURITIES.

SECURITIES such as those referred to in the previous chapter possess features that render them exceptionally desirable for investment. These bonds are, in effect, a first mortgage upon all the lands in the district, but unlike the money loaned upon mortgages, the proceeds of these bonds are directly devoted to the enhancement of the value of the original security, thus giving them an added value which is possessed by no other form of bond. They have exactly the same foundation as a city or county bond. Of course, the merits of each district must be investigated separately, just as when loans are made upon real estate.

The law providing for the formation of districts has in several cases been declared constitutional by the courts. A statute was enacted by the legislature of 1889 providing for the confirmation by the courts of the state of all proceedings had for the organization of a district, and for the issuance of its bonds. This decree, when once had, determines conclusively and forever the validity, not only of the organization, but also of the bonds of the district. This means that at no time after the decree becomes final will any objection be heard by the courts as to the validity of the district, or of its bonds. This confirmation act throws around irrigation district bonds a safeguard never heretofore vouchsafed to municipal bonds of any character, in any state of the Union.

Irrigation bonds met with quiet but determined opposition, at the outset, from persons who were interested in water rights with which some of the districts would conflict. The bonds have, however, steadily risen in the estimation of investors, not only in California but throughout the United States and in Europe.

C. P. Huntington, the level-headed railway president and financier, recently expressed his opinion in regard to these bonds as follows:

The existing status of the case appears to be:

First: Irrigation confers greatly enhanced value on the lands subject to it.

Second: The irrigation bonds issued as relating to any particular district, if such bonds have been issued in strict conformity with the statutes of the state, are a first mortgage upon the lands lying subject to the irrigation system constructed from the proceeds of their sale. The bonds are, therefore, a mortgage upon valuable real property.

Third: As a rule, and perhaps in all cases, the value of the land greatly exceeds the amount of the mortgage to which it is subject, and it should therefore follow that bonds being a legal and valid first lien upon property greatly in excess of their face value and interest, are perfectly solvent securities, equal to if not better than the mortgages upon real estate which are deemed by bankers and investors to be preferred security for the repayment of loans.

One ground of criticism, for which there is some foundation, is that bonds of districts have in some cases been separated and offered at widely varying prices, which has naturally hurt them on the market. This was an error of inexperience not likely to be repeated.

Another form of security whose certain value is greatly enhanced by the act of irrigation is the mortgage upon farm lands. It is the almost universal testimony of financiers and investors that no form of loan is superior in its safety to a first mortgage upon land. This form of mortgage is regarded as perfectly secure, because of its almost absolute certainty to yield an income from which the interest can be realized. But on irrigated lands this very security is greatly enhanced, because there can be no such thing as a crop failure on irrigated lands. Prices of produce may fluctuate, but the crop itself is always sure and certain, very much more so than on lands depending upon rainfall for a revenue. There is no form of security in the world more certain to be able to pay its interest promptly than first mortgage on irrigated lands in California.

WHERE THE CONGRESS MEETS.

THE CITY. The International Irrigation Congress meets in the city of Los Angeles in Southern California, October 10 to 15, 1893. Los Angeles is the commercial metropolis of the southwestern portion of the Union and is the second largest city of the Pacific Coast. Its present population is about 65,000.

Three transcontinental railway lines connect Los Angeles with the East. The Central Pacific crosses northern Nevada connecting at Sacramento, California, with the Southern Pacific, which runs south through the San Joaquin valley to Los Angeles. The Santa Fe through route from the East passes through northern New Mexico and Arizona, entering the state at Needles. The Southern Pacific Sunset route runs direct from New Orleans to Los Angeles, skirting along the northern edge of Mexico to Yuma, thence northwest to the metropolis. Besides these three transcontinental twelve local railway lines enter the city. The various routes of the Southern California railway, the California section of the A. T. & S. F., the Southern Pacific, the Terminal and the Redondo gridiron the southern section of the state in all directions and seventy independent trains enter and the same number leave the city every day.

Los Angeles is thoroughly a modern city although founded over a century ago. Enough of the ancient regime remains to contribute an element of historical interest. Ten years ago it was a quiet semi-Mexican town of 12,000 people. The rapid development of this surrounding section under irrigation caused a sudden influx of settlers—Americans chiefly from the middle northern states—and a remarkable change came to pass, yet Los Angeles is in no way open to the reproach of being a boom town. Since 1888 the growth has been steady and natural and a great part of the improvements have been achieved since then. The residence sections contain 100 miles of graded and graveled streets, with more cement sidewalks than any city three times its size in the Union and lined with handsome residences and highly cultivated grounds. The business section contains many blocks of four, five and six story buildings on ten miles of paved (bituminous rock) streets. The city is lighted with electricity, has an ample water supply, is clean and healthy. Cable and electric car lines ninety miles in length penetrate every section of the city. Two leading hotels, the

Hollenbeck at the corner of Second and Spring, in the center of the city, a well equipped hostelry, and the Nadeau, at First and Spring, where both cable and electric lines meet, have been engaged as headquarters for the Congress. The St. Elmo is a comfortable family hotel on North Main street, where good accommodations and reasonable rates prevail.

THE COUNTY. The section of country in which Los Angeles is situated is one of the most prosperous to be found on the continent. The fact that this prosperity is largely the outgrowth of the practice of irrigation makes Los Angeles the most appropriate spot that could be selected at this time for the holding of the International Irrigation Congress.

The population of the county is 101,454, of all of Southern California 201,352. The chief products of the section are oranges and lemons, barley, wheat, corn, apricots, peaches, prunes, grapes, wine, beans and vegetables, raisins, pampas plumes, wool, honey, sugar beets and sugar, olives and olive oil, English walnuts, preserves, jams, etc.

Ten years ago the property of the county was assessed at twenty millions of dollars. At present it is assessed for eighty-four millions. The area of the county is 2,606,400 of which a little more than half is good agricultural land. About 30,000 acres are irrigated and the mountains contain water sufficient to irrigate nearly four times that amount. Semi-tropic fruits are raised in the county to the value of over \$2,000,000 annually. A similar amount comes in from the cereals and about as much more from deciduous fruits.

The seaboard of the county contains three shipping points, Redondo, Santa Monica where the Southern Pacific has constructed the longest ocean wharf in the world, and San Pedro where the government has spent \$900,000 in improvements.

The affairs of the county are ably managed by a Board of Supervisors with the following membership: J. W. Cook, chairman; E. A. Forrester, A. W. Francisco, James Hanley and James Hay.

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International
Irrigation Congress
October 10 to 15,
Los Angeles
Cal.